

CLAIMS

1. A water-lifting pump apparatus comprising:
a suction tank;
5 a discharge tank;
a pump for pumping water in said suction tank into said
discharge tank, and a discharge piping connected to a
discharge side of the pump;
actuating means for driving said pump;
10 a reverse flow preventing mechanism for preventing a
reverse flow of water pumped into said discharge tank toward
said discharge piping; and
back flow rate control means for controlling the flow
rate of a waterfall falling from said discharge piping into
15 said suction tank when pumping operation is finished.

2. A water-lifting pump apparatus according to claim 1,
wherein said reverse flow preventing mechanism comprises an
overflow mechanism having a dam disposed in said discharge
20 tank.

3. A water-lifting pump apparatus according to claim 1,
wherein said reverse flow preventing mechanism comprises a
reverse flow prevention valve disposed on a distal end of
25 said discharge piping.

4. A water-lifting pump apparatus according to claim 1,
wherein said reverse flow preventing mechanism comprises a

siphonic piping disposed in said discharge piping.

5. A water-lifting pump apparatus according to any one of claims 1 through 4, wherein said back flow rate control
5 means controls a rotational speed of said pump while keeping the pump rotating in a normal direction.

6. A water-lifting pump apparatus according to any one of claims 1 through 4, further comprising:

10 a bypass piping interconnecting an upstream side and a downstream side of said pump in bypassing relation to the pump;

wherein said back flow rate control means adjusts the flow rate of the waterfall falling through said bypass
15 piping and controls a rotational speed of said pump while keeping the pump rotating in a normal direction.

7. A water-lifting pump apparatus according to claim 6, wherein the rotational speed of said pump is controlled so
20 that the waterfall does not pass through said pump.

8. A water-lifting pump apparatus according to any one of claims 1 through 4, wherein said pump has a movable vane mechanism for adjusting the vane angle of an impeller, and
25 said back flow rate control means adjusts the vane angle of the impeller.

9. A water-lifting pump apparatus according to any one

of claims 1 through 8, further comprising:

a reversal prevention device for preventing said actuating means from being reversed.

5 10. A method of controlling operation of a water-lifting pump apparatus for pumping water in a suction tank into a discharge tank with a pump and a discharge piping connected to a discharge side of the pump, comprising:

after the pumping operation is finished, controlling a
10 rotational speed of said pump while keeping the pump rotating in a normal direction, thereby to control the flow rate of a waterfall falling from said discharge piping into said suction tank.

15 11. A method of controlling operation of a water-lifting pump apparatus according to claim 10, comprising:

after the pumping operation is finished, reducing the rotational speed of said pump which rotates in the normal direction thereby to lower the water level of water in said
20 discharge piping or said discharge tank.

12. A method of controlling operation of a water-lifting pump apparatus for pumping water in a suction tank into a discharge tank with a pump and a discharge piping
25 connected to a discharge side of the pump, comprising:

after the pumping operation is finished, causing water in said discharge piping to fall into said suction tank through a bypass piping interconnecting an upstream side and

a downstream side of said pump; and

simultaneously, controlling a rotational speed of said pump while keeping the pump rotating in a normal direction.

5 13. A method of controlling operation of a water-lifting pump apparatus according to claim 12, comprising:

controlling the rotational speed of said pump so that the waterfall will not pass through said pump.

10 14. A method of controlling operation of a water-lifting pump apparatus according to claim 13, wherein the rotational speed of said pump, which rotates in the normal direction after the pumping operation is finished, is a rotational speed for maintaining the lowering water level in
15 said discharge piping each time the water level is lowered.